(No Model.) 3 Sheets—Sheet 1.

A. LE PRINCE.

METHOD OF AND APPARATUS FOR PRODUCING ANIMATED PICTURES OF NATURAL SCENERY AND LIFE.

No. 376,247. Patented Jan. 10, 1888.

Fig. I.

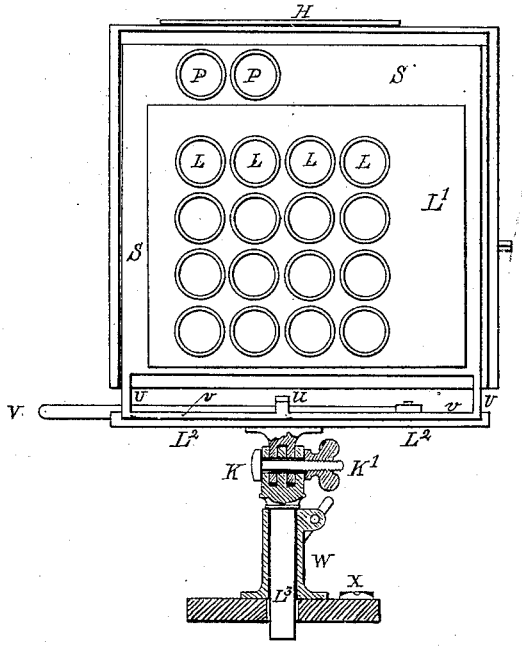


Fig. 2.

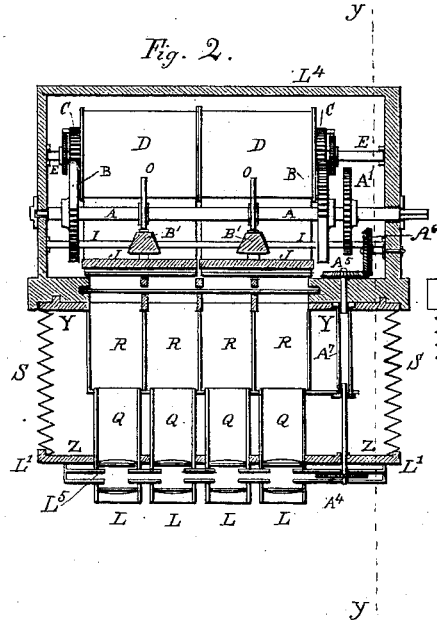
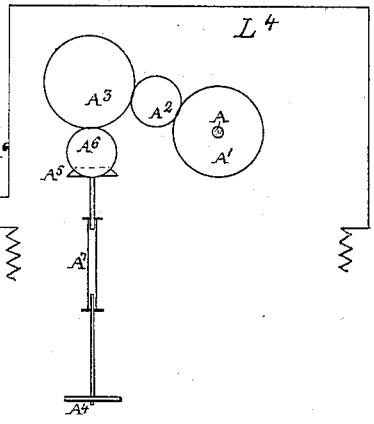


Fig. 2A.



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A. LE PRINCE.

METHOD OF AND APPARATUS FOR PRODUCING ANIMATED PICTURES OF NATURAL SCENERY AND LIFE.

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Fig. 3.

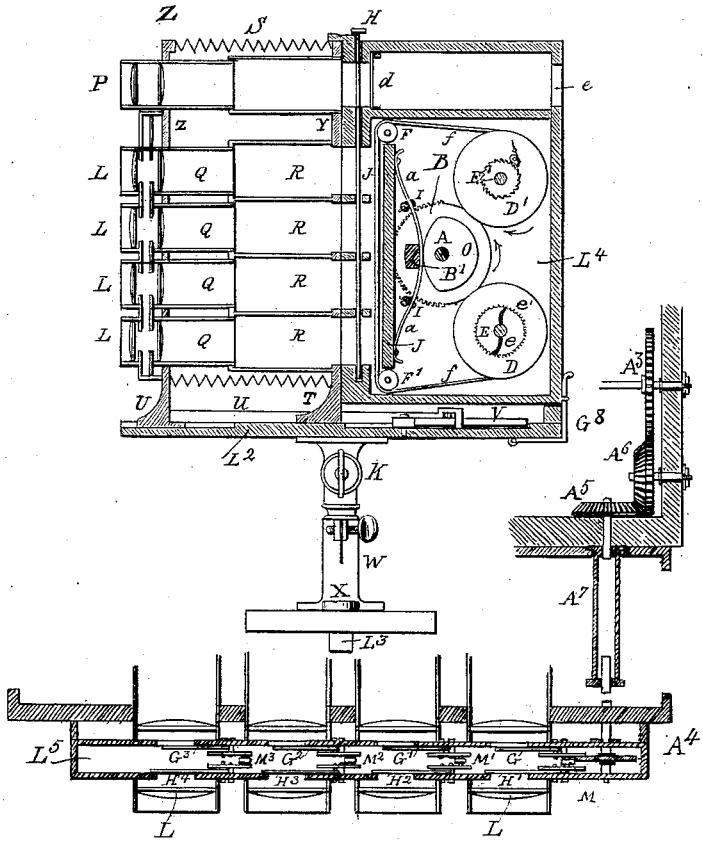


Fig. 4.

Fig. 5

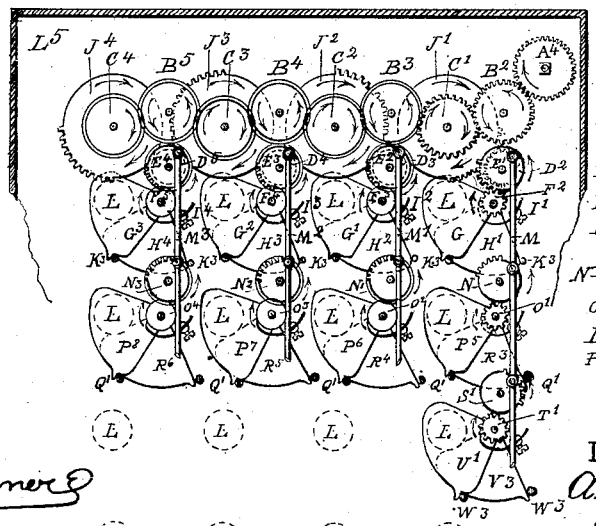
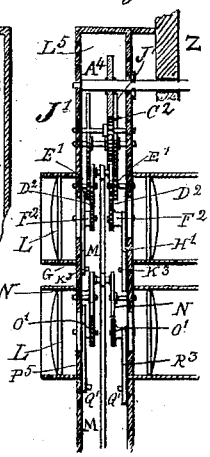


Fig. 6.



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METHOD OF AND APPARATUS FOR PRODUCING ANIMATED PICTURES OF NATURAL SCENERY AND LIFE.

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Fig. 7.

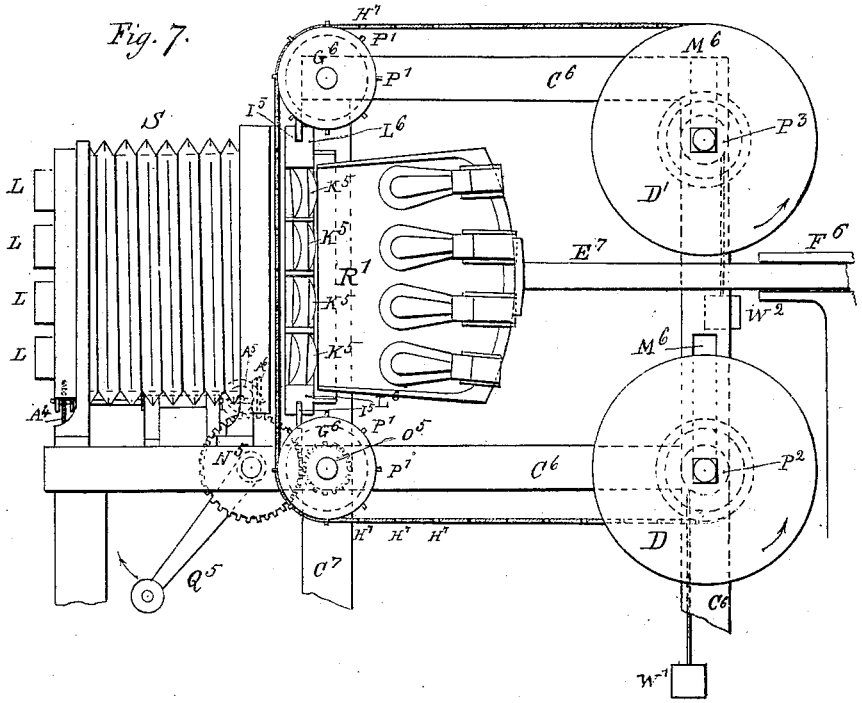
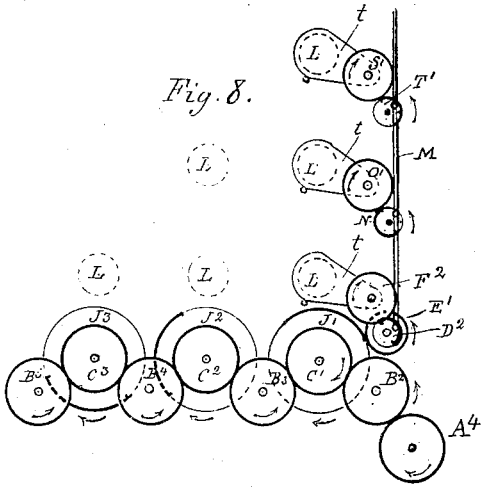


Fig. 8.



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UNITED STATES PATENT OFFICE.

AUGUSTIN LE PRINCE, OF NEW YORK, N. Y.

METHOD OF AND APPARATUS FOR PRODUCING ANIMATED PICTURES OF NATURAL SCENERY AND LIFE.

SPECIFICATION forming part of Letters Patent No. 376,247, dated January 10, 1888.

Application filed November 2, 1886. Serial No. 217,809. (No model.)

To all whom it may concern:

Be it known that I, AUGUSTIN LE PRINCE, of the city, county, and State of New York, have invented certain new and useful Improvements in the Method of and Apparatus for Producing Animated Pictures of Natural Scenery and Life on Glass, Canvas, or other Prepared Surfaces, of which the following is a full, clear, and exact description.

In order to carry out my method I provide an apparatus consisting of a receiver or photo-camera and a deliverer or stereopticon adapted to throw the transparent pictures obtained by means of the said camera or receiver in the same order and time in which they were taken, as will be hereinafter fully described and claimed.

The transparent pictures thrown in quick succession on a finely-ground plate-glass or other suitable material will produce on the eye of the spectator the same effect or impression as the objects themselves when in motion in front of the "camera-receiver."

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 represents a front view of the receiver, showing a set of sixteen lenses, L, set in the shutter-box L′, fixed upon the front of bellows-camera S, resting on bed L^2 and sliding on feet U by means of lever V. The lower part shows a section of the knee-joint K and friction-socket W with air-level X, allowing the camera to revolve on spindle L^3 and to be fixed at any angle backward and forward by thumb-screw at K′. The two lenses P at the top are the focusing-lenses, and H the shutter in motor-box.

Figs. 2 and 2^A represent a sectional plan view and detail of the receiver, showing in the lower or front part the lenses L of objective provided with tubes Q, sliding in square boxings R, so as to allowing focusing. In the upper or back part the supply and motor box L^4 is shown, the motor-shaft A, with half gear-wheels B B, transmitting alternatively the motion through gear-wheels C C to lower drums, D D, loose on shafts E E, and through wheel A′ and gear-wheels A^2 A^3 and cog-wheels A^5 A^6 (shown in Fig. 2^A) transmitting motion through socket A^7 to gear A^4 in shutter-box L^5. (Detail in enlarged Figs. 4, 5, and 6.)

Fig. 3 is a sectional side elevation of receiver, showing the above, and more particularly the supply-drum D, storing-drum D′, with film *f*, guided over rollers F F′ in front of pads J, faced with cloth or rubber, and pressed alternately against the film by blocks B′, pressed by cams O and released by springs *a a*, fixed to the back of pads J and to the rods I, running across and fixed in sides of motor-box L^4. It shows also the section of focusing-lenses P with glass screens *d* and peep-holes *e*, and the action of focusing-lever V and rod *u* in moving forward and backward the front part of objective. The spring hasp G^8 holds the motor-box tight against the objective and allows one to take it off readily and replace it with another after full exposure of the film or drums D. Referring again to Fig. 2^A, this is a section of the motor-box through *y y* in Fig. 2, showing transmission of power from main shaft A to wheels A′ A^2 A^3 and cog-wheels A^5 A^6 to socket A^7 and wheel A^4, Figs. 4 and 5, and giving motion to the shutters in box L^4, Figs. 4, 6, and 7.

Fig. 4 is an enlarged sectional plan showing the transmission from shaft A to wheel A^4, but the section through the lenses is lower down, and shows only the position of shutters G G′ G^2 G^3 and H′ H^2 H^3 H^4 and connecting-rods M M′ M^2 M^3.

Fig. 5 is an enlarged front elevation of the system of shutters with transmission from wheel A^4 to runners B^2 B^3 B^4 B^5, gear-wheels C′ C^2 C^3 C^4 and quadrant mutilated gear-wheels J′ J^2 J^3 J^4 to double pinions, and quadrant mutilated gear-wheels E′ and D^2, E^2 and D^3, &c., to double shutters G H′, G′ H^2, G^2 H^3, G^3 H^4, with springs I′ I^2 I^3 I^4 to bring them to first position as soon as cog-teeth D^2 D^3 D^4 D^5 leave off. It shows also, rods, M M′ M^2 M^3 transmitting motion vertically from shutter to shutter for each set of lenses.

Fig. 6 is an enlarged sectional side elevation showing the double sets of mutilated wheels J′, also double pinions and mutilated wheels D^2 E′ and pinions F^2, with their shutters G H′, and stop-pins K^3, together with the crank-pins connecting the double quadrant mutilated gear-wheels D^2 N, &c., with the connecting-rod M.

Fig. 7 is a side elevation of the deliverer, the objective being the same as in the receiver only shows the outside frame and bellows S. The back part is in section through center, and shows the film transparencies mounted on two metallic ribbons punched with holes H', fitting on pins P', driven in guide-rollers G^6 G^6, stored on drums D D', loose on shafts with square ends, and lying in grooves M^6 M^6 provided in frame-work C^6. The weights and small cables W' W^2, rolled on small pulleys P^2 P^3, fixed on drums D and D', secure the tightness and steadiness of the films. At the back of the films is the reflector R', with sixteen or more incandescent lights held by rod E', sliding in socket F^6. In front of reflector are a set of sixteen double condensers, K^5 K^5, throwing the light through the sixteen pictures, and mounted on a frame, L^6, grooved at I^5, so they may slide in and out laterally on frames C^6 when required. The guide-roller G^6 carries a pinion, O^5, gearing in wheel N^5, fixed to frame C^6, and provided with crank Q^5 or any other device to transmit power.

Fig. 8 is a diagram showing the special disposition of shutters, the same as in Fig. 5, but arranged for long exposures, the dark lines showing the full gearings and the cogs on mutilated gear-wheels.

A suitable subject having been found, the photo-camera or receiver is brought in front and focused. The receiver is composed of three parts: first, the objective; second, the supply and motor-box; third, the stand.

The objective is a system of three, four, eight, nine, sixteen, or more lenses of equal focus secured in a vertical brass plate or frame, Z. Two light brass plates fixed in front of Z form a boxing, in which the instantaneous shutters work automatically, as explained hereinafter. The drawings show an objective of sixteen lenses. On the back side of the plate Z each lens is provided with a light brass boxing, Q, sliding in and out of a corresponding set of brass partitions, R, slightly larger and fixed on the front side of the back plate, Y. The other four sides of the box S are made of rubber bellows, so no light can penetrate except through the lenses. The back plate, Z, is provided with sixteen square openings, and securely fixed at T, Fig. 3, to a horizontal bed or board, L^2, provided with two slides or grooves, in which the lower corners, U, of the front brass plate, Z, can slide backward and forward by rack-and-pinion or lever action, to allow accurate focusing. Figs. 1 and 3 show lever V pressing on eye-hole in square rod *u* on transverse bar *v*, connected with corners or feet U U of front plate, and pushing or pulling it forward and backward, as required. Under the bed-plate L^2 is a knee-joint, K, allowing inclination backward and forward upon a strong rod, L^3, revolving in a friction split socket, W, fixed in the upper part of the stand, and provided with small spirit-level X, so that the objective may be inclined backward and forward, and, revolving upon rod L^3, be brought to face any object around the operator without interference with the inner action of the motor-box or the focusing of the moving objects at various distances, while at the same time the verticality of the lateral sides of the pictures is maintained. The supply and motor box fits at the back of the objective by overlapping at top and sides of back plate, Y, of the objective, and is held in position by spring-lock G^8, hinging on plate L^2. The front part is provided with sixteen openings corresponding to those in back plate, Y, of the objective, and a sliding shutter, H, closes communication of the whole set of lenses previous to exposing the films or removing the supply-box to dark-room.

The sensitive films *f* are stored on the two lower drums, D D, set on spindle E, upon which they revolve independently as required, tension being secured by springs *e*, fixed through spindle E and pulling on teeth *e'*, set in the inner circle of a ring fixed on the outer sides of drums D D, Fig. 3. From thence they are carried over small guide-rollers F F and F' F', Fig. 3, presenting a flat surface facing the lenses for exposure, and ultimately wind over an upper set of drums, D D', loose on upper spindle, E', and provided with gearing-wheels C C on their outer faces or disks. These wheels C C gear alternately with two mutilated gear-wheels, B B, Fig. 2, fixed on main motor-shaft A, passing through the box, and provided at one end with a square head to carry a crank for hand-power or for any other power, such as a weight and blocks, spring and clock-work, compressed air, electricity, &c. The length of the mutilated gear on wheels B B will be sufficient to pull in one revolution of the main shaft A a length of film equal or greater than the total height of the square openings in front of the lenses L. The shaft A carries, also, two cams, O O, Figs. 1 and 2, which press forward, during one-half of their revolution, two blocks, B' B', fixed on two springs, *a a*, held by screws on light rods I I, passing through the box. The springs are also fixed at their ends to two vertical pads, J J, a trifle wider than the films, so as to hold them flat and tight against the openings in front of box during exposure and release them immediately after, while the mutilated gears revolve drums D', alternately storing the exposed surfaces and bringing new ones in position to be operated upon.

On the left inner side of the power-box a set of cog-wheels, A^5 A^6, Figs. 2, 2^A, and 4, gears with main shaft A by wheels A' A^2 A^3 and transmits motion to the shutters in front brass box L^5 of objective by means of the cog-wheel shaft, which is square and revolves the socket A^7, in which the square shaft of wheel A^4, Figs. 2^A and 4, commanding the shutters, may slide while the objective focus is altered during exposure, as may be required. The wheel A^4 gears with runners B^2 B^3 B^4 B^5 and wheels C' C^2 C^3 C^4, all alike. The latter are fixed to larger wheels, J' J^2 J^3 J^4, provided

with quadrant of cogs, each gearing successively on small pairs of wheels E' E^2 E^3 E^4, having as many teeth as there are cogs. They are fixed themselves to larger pairs of wheels, D^2 D^3 D^4 D^5, also provided with quadrant of cogs gearing with the double pinions F^2 F^3 F^4 F^5, fixed on shutters G and H', G' and H^2, &c., Figs. 5 and 6.

Four connecting-rods, M M' M^2 M^3, connect vertically the four sets of double shutters, and every one of the sixteen small pinions F^2, O', T', &c., is provided with a spiral spring, I I' I^2 I^3, &c., which brings the shutters back to first position, to pin K^3 Q', &c., as soon as they are out of gear. So with the first quarter of a revolution of wheel A^4 cogs J' will work small wheel E' one revolution, and during the first quarter of that revolution cogs D^2 will work the pinions of shutters G and H', so that G will be raised over lens-opening L, while H' comes up and closes it; but as the cog gearing on pinion of shutter H' has one, two, or three teeth less than that of shutter G, the pinion of shutter H' will be so much sooner out of gear and brought down by spring I', giving the exposure, which is brought to an end by the subsequent fall of shutter G. The next quarter of a revolution of small wheel E' will, by means connecting rod M, work shutters P^5 and R^2 in the same way; then the third and fourth quarters will act on the other two lenses below, completing one of the vertical sets. The second quarter of revolution of wheel A^4 will act precisely in the same way upon the next vertical set commanded by cog J^2, the third quarter on cog J^3, and the fourth on cog J^4. So, for each revolution of A^4, Fig. 5, corresponding to one revolution of main driving-shaft A, Fig. 3, I have sixteen exposures; and, as during the second half of the revolution the film of the first drum has been replaced by a fresh length, the part acted upon being stored on upper drum, there is no interruption in the exposure, the slow speed of one revolution per second giving nine hundred and sixty pictures per minute. So several thousand may be taken with ease in the same time; and with drums of large diameter and a few store-boxes ready to fix behind the objective while the drums are removed and replaced in the dark-room it becomes possible to record, and by means of the deliverer to reproduce afterward, the aspect of any scenery, meeting, procession, races, &c., under fair conditions of light.

The stand, as already stated, is provided with a friction-socket, W, to receive the vertical rod L^3, fixed to the bed L^2 of the camera. It is a strong telescopic tripod with a hook and chain fixed under the disk to increase its stability by a heavy weight or stone hanging near the ground.

In the deliverer, Fig. 7, of my apparatus the objective is the same as in the receiver, with the exception that the lenses L are a little further apart and convergent toward a point at the distance required to show the picture, the shutters are single, and the mutilated wheels are provided with twice as many teeth, so as to give full exposure and no interruption between the successive pictures, Fig. 9. The store-box is replaced by a reflector, R', and frame-work C^6, provided with at least as many incandescent electric lights as there are lenses and sliding backward and forward through socket F^6 by means of rod E^7. Between this reflector and the films a frame, L^5, containing the condensers K^5, is brought in position by means of slides I^5 I^5 in uprights C^7.

The transparencies are adjusted on a pair of endless metallic ribbons accurately punched with small round holes H^7, in which fit the pins P', fixed on the driving and guide drums G^6, so that after having been wound around drum D they are pulled and brought in position alternately by the action of gearing-wheels N^5 O^5 and crank Q^5.

The drums D, fixed on uprights C^6, let out the transparencies rolled on them, as required, and they are received on rollers D' after exposure. All the while the transparencies are kept tight on both rollers by weights W' W^2, hanging on cables wound on pulleys P^2 P^3, fastened on one end of each drum. The shutters are also worked by wheel N^5 through cog-wheels A^5 A^6 to wheel A^4. The shutters *t* are single and work similarly to those of receiver, as shown in diagram Fig. 8.

For subjects requiring fewer pictures and admitting repetition—such as waves, cascades, &c.—the drums are replaced by two polygonal disks, A^8 A^9, Figs. 9 and 10, and supported by frame N^6, which may be fixed bodily on frame C^6, Fig. 7. The disks are divided geometrically into as many segments as one-fourth the total number of transparencies constituting the pictures. They are caused to revolve as explained in description of Figs. 9 and 10, and will be thrown successively on the screen by the revolution of quadrant-opening R^2, so as to require a set of four lenses, the reflector R' requiring only a corresponding number of lights and condensers—*i. e.*, four.

The sensitive film for the negatives may be an endless sheet of insoluble gelatine coated with bromide emulsion, or any convenient ready-made quick-acting paper, such as Eastman's paper film. The exposure will be given as described and development carried out as usual, care being taken to mark the negatives in their regular order before cutting them when required.

The sensitive film for the transparencies or positives must be on a transparent flexible material—such as gelatine, mica, horn, &c.—for the larger deliverer with drums. They may be thin glass for the disks of smaller deliverers. Once well developed and toned, the transparencies will pass through the hands of artists, who will tint them in transparent colors, dyes, or lacquers, as the subject may require, and they will be ready for mounting and adjusting between the metallic ribbons,

which will bind them together for the larger deliverer, or in the slides provided at the outer edge of disks for the smaller deliverer.

When the animated pictures to be taken are of long duration, the receiver has to be provided with one or more supply and motor boxes, to be fixed to the back of objective as soon as the films on supply-drums of the first box are exhausted. These may then be taken to the dark-room or tent and have new drums fixed by an assistant, while the operator attends to the receiver.

By the process and with the apparatuses described I am enabled to take at regular intervals any number of successive pictures of the same objects in motion, and practically to produce during any length of time as many and more pictures than the quickest eye could detect in the same period of time in looking at the objects themselves, and with the deliverer carry out or complete any process and reproduce and reconstitute such flying pictures in the same order and period of time in which they were taken, producing upon the eye of the spectator at any other time or place the very same effect or impression produced at the time of taking the photographs with the receiver.

It is obvious that the details of the mechanisms forming my apparatus might be greatly varied without departing from the spirit of my invention.

I do not claim the particular construction of the stereopticon or deliverer in this application, as I propose making the same the subject of a separate application.

By my invention I am enabled to take negatives of any object or objects at intervals, regular or irregular, and with or without short or long interruptions, and at the slowest or most rapid speed, regular or irregular, as may be wanted, attaining several thousand per minute, and provision is made for moving the objective in any direction required—horizontally, vertically, or both simultaneously—and also to lengthen or shorten the focus while taking the pictures, the apparatus being essentially portable and self-contained, and independent of the objects or subjects of which it takes the pictures, and entirely under the control of the operator, and adapted to act equally well upon solid ground or moving platforms, such as boats, cars, balloons, &c.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. A photographic receiver comprising a casing, a series of lenses therein, a series of shutters therefor, and connections between the said shutters for successively and continuously operating them at regular intervals, whereby negatives of the same object from the same point of vision may be produced upon a suitable surface, substantially as set forth.

2. The photographic receiver provided with a series of lenses, a series of shutters, and means for operating them successively and continuously, in combination with film-drums and means for operating them intermittently for moving the film in the dark-box, substantially as described.

3. The receiver provided with a series of lenses and shutters and means for operating them successively and continuously, in combination with the film-rollers, the pad J, and means for reciprocating it, substantially as and for the purposes set forth.

4. The combination, with the series of lenses and the series of tubes R, for receiving the lens-tubes Q, the latter held upon an independent frame, and means for moving said frame and lens-tubes out and in for changing the focus during successive exposure, in combination with the series of successively-operated shutters for closing the lens-tubes, substantially as described.

5. An apparatus for producing animated pictures and delivering the same upon suitable surfaces, comprising a photo-camera provided with series of lenses and shutters and means for operating the shutters, and a deliverer or stereopticon provided with mechanism for delivering or throwing the pictures obtained by the camera mechanism upon a surface in approximately the same order and time in which they were received, substantially as set forth.

6. An apparatus for producing animated pictures, comprising a photo camera having the shutter mechanism and removable and interchangeable film-box and stereopticon-reflector, whereby the camera may serve the twofold purpose described, substantially as set forth.

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